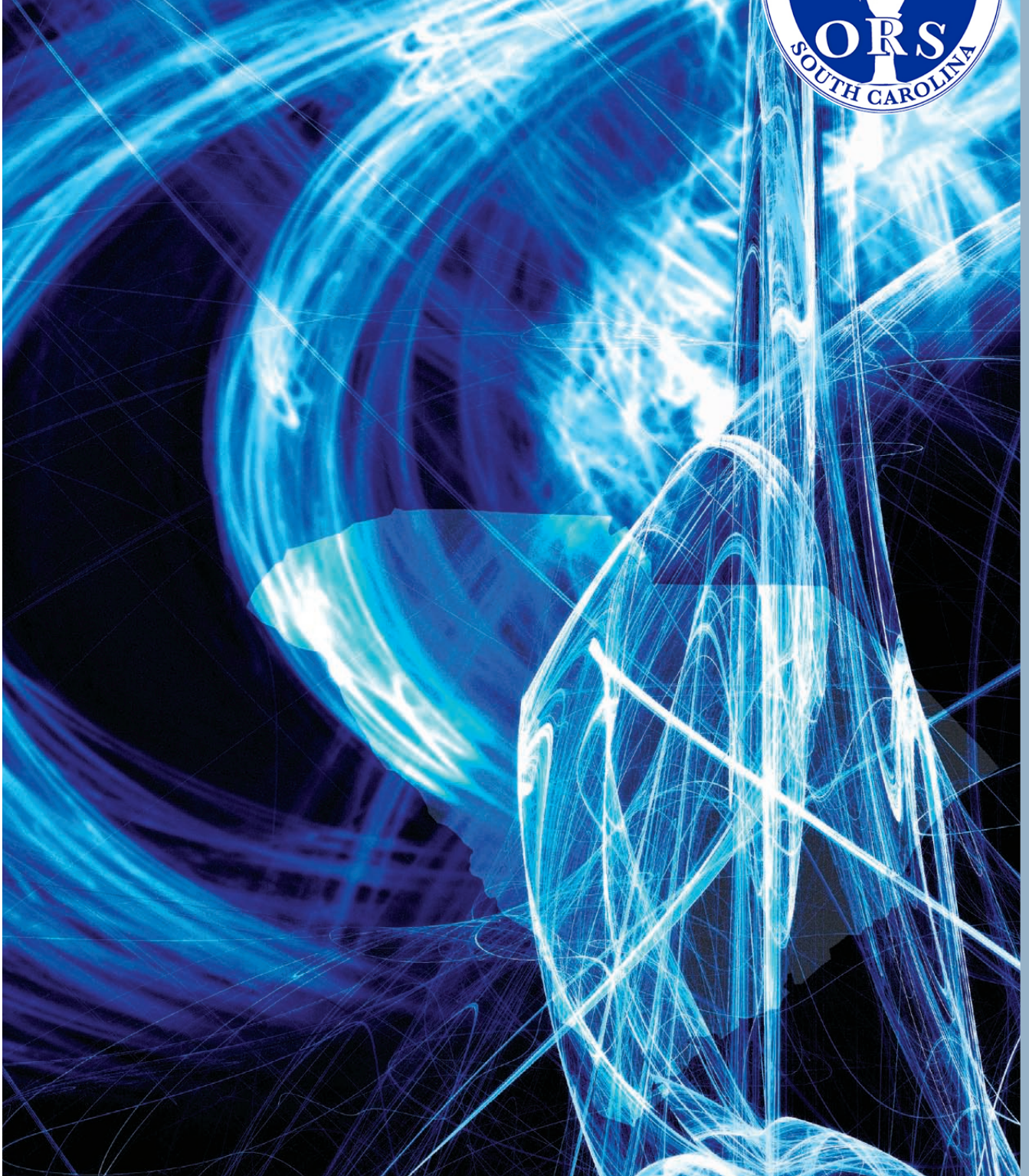


An analysis of South Carolina's current electric usage conditions with recommendations for a responsible future



Report prepared by:

South Carolina Office of Regulatory Staff

for

State Regulation of Public Utilities Review Committee

Submitted this 11th day of December 2008

EXECUTIVE SUMMARY

The South Carolina Office of Regulatory Staff (ORS) was asked to conduct a comprehensive survey and prepare a report with recommendations for the Public Utilities Review Committee regarding current energy providers' capabilities, current and future energy policies as well as how changes in federal policies could impact South Carolina.

The ORS report is an objective study focusing on how changes in federal energy and environmental policies or legislation might impact South Carolina based on this state's demographics, geographic location, the current availability of renewable resources and a myriad of other factors. The report relies in large part on the underlying assumption that South Carolina desires to continue to have reliable and reasonably priced electricity while considering the impact on the environment.

Change in the areas of electric generation and federal environmental policy are inevitable and South Carolina must prepare for these changes, but must do so while maintaining reliable and affordable electricity.

The ORS report provides a review of the existing electric system in South Carolina. This evaluation of our electric system shows that 61% of the electricity used in this state was generated from coal-fired facilities in 2007. This figure highlights the substantial impact federal laws or changes in environmental policy, which tax or cap carbon dioxide (CO₂) emissions, would have on South Carolina's electric utilities and their customers. To date, South Carolinians have enjoyed relatively low electricity prices due, in large part, to our reliance on lower-cost nuclear and coal generation. With an expected growth in population and demand for electricity, South Carolina will need a diversity of resources to meet this growing demand, while focusing on increased environmental protections.

The report provides detailed information regarding South Carolina's electric generation, use and population demographics. It also explains why these factors are significant in estimating the impact changes in federal laws and regulations for carbon emissions would have on South Carolina.

South Carolina electric generation facilities currently emit approximately 47 million tons of CO₂ annually. At this rate, if emission allowances were sold for \$30 per ton, South Carolinians would be charged an additional \$1.4 billion annually in environmental costs. This number is in addition to the \$2.1 billion expended already by South Carolina utilities for capital projects to reduce emissions and an additional \$1.5 billion, which must be spent by 2013. While change in federal environmental laws are inevitable and needed, South Carolinians, who have lower median incomes and above average electric use compared to national averages, clearly cannot afford to bear an unequal share of these additional expenses.

The population of South Carolina is estimated to increase by 28.3% between 2000 and 2030, to more than 5 million residents. South Carolinians have an annual median household income that ranks 40th in the country at \$42,561 and the 5th highest average annual consumption of electricity of 14,340 kWh per residential customer. This high consumption number is due, in large part, to South Carolina's climate, which is ideal for the use of electric-powered heat pumps as well as the large number of residents who reside in energy-inefficient housing.

While South Carolina is fortunate in many ways, we are currently lacking any significant sources for renewable electric generation. South Carolina utilities anticipate 4% of the state's generation will come from renewables by 2027, which correlates with the results of a study prepared by La Capra Associates in September 2007. This study estimates that South Carolina only has the practical potential for 665 MW of renewable generation within the next decade.

While advances in technology may greatly increase the practical potential for the use of renewable generation in the future, the current high costs and low generation potential for renewable energy dictates that South Carolina must continue to use a mix of nuclear, coal and natural gas generation in the near future to ensure reliable, affordable electricity.

ORS concludes that South Carolina will need a diversity of resources to meet our future electric needs while focusing intently on the protection of our environment. We should promote nuclear power generation and recognize that coal, for the foreseeable future, will be a part of the generation mix along with natural gas. Research and development will need to be conducted to increase energy generation from renewables. Energy efficiency, demand-side management and conservation need to be promoted, publicized and encouraged.

An analysis of South Carolina's current electric usage conditions with recommendations for a responsible future

The following is a first-of-its-kind, comprehensive collection of data that reflects South Carolina's electric production methods and consumption behaviors.

Included is an unbiased analysis of that factual data. From that data, recommendations have been made to ensure South Carolina is responsible in continuing to supply dependable, affordable electricity to all its citizens and businesses while, over time, minimizing environmental impact.

Electricity is one of the most critical contributing elements to our quality of life. Almost nothing we depend on in today's world would exist without it. Electricity cooks our food, heats our homes, lights our roads, powers our hospitals and runs our computers. It does not matter from which socioeconomic group you are from; it is available to everyone and is elemental for our health, safety and security.

But as we move forward in this ever-changing and evolving world, we must recognize that it is in our humanitarian and national self-interest to embrace the crucial and required changes that will preserve the way we live and the environment around us. The question is; how do we go about it?

It is our recommendation that any energy production and consumption plan adopted, must include:

- *Dependable and available generation capacity to meet demand.*
- *Reserves to ensure South Carolina against future blackouts, brownouts or multiple interruptions of power.*
- *Objectives and timelines that do not unfairly burden or dramatically, economically penalize our state, its people, businesses and industries.*
- *Financial assistance for lower-income families and individuals who will be the most negatively impacted.*

I.

Available South Carolina governmental resources for the development of future energy policies.

Assignment of responsibility among our state's agencies for regulation of electricity availability, electricity cost, and the impact of the production and use of electricity on our environment has evolved over the last century. The South Carolina General Assembly created the following regulatory programs and assigned responsibility for implementation of these programs based upon challenges confronting the state at the time of inception:

- *The South Carolina Public Service Commission for the stabilization of capital for investor-owned utilities in the early 20th century through the New Deal era.*
- *The South Carolina Department of Health and Environmental Control for the protection of our fragile environment and our citizens' health.*
- *The State Energy Office to educate consumers about energy use arising out of the turbulent oil embargo era.*
- *The Office of Regulatory Staff to meet the need for an efficient and empowered representation of the broad public interest in utility matters.*

Under current law, our state energy policy is the product of a disconnected series of regulated transactions and other agency educational programs.

These agencies and programs are:

Association of South Carolina Energy Managers (ASCEM)

ASCEM provides information to members to foster a common energy management program for South Carolina and consolidates experience, knowledge and interest in the field of energy management. This association also disseminates information, shares strategies for financing and implements energy efficiency projects.

Low-Income Home Energy Assistance Program (LIHEAP)

LIHEAP assists qualified households with utility bills. This program is administered by the Governor's Office of Economic Opportunity in coordination with the community action agencies.

Natural Gas Exploration Study Committee

This study committee was created to examine the feasibility of natural gas exploration in the Atlantic Ocean off the coast of South Carolina.

Palmetto Clean Energy (PaCE)

PaCE provides state-regulated electric utility customers the option to voluntarily support the development of renewable energy resources such as wind, solar, hydroelectric and biomass. If a customer chooses to participate in the program, the customer can subscribe with the local utility and the utility will collect the customer's contribution. The utility will then remit all such funds to Palmetto Clean Energy, Inc., a 501(c)(3). PaCE's governing board is composed of the three major South Carolina investor-owned utilities, the Office of Regulatory Staff and the State Energy Office.

Palmetto State Clean Fuels Coalition (PSCFC)

PSCFC is part of the Clean Cities program and is one of 88 designated coalitions in the United States. Clean Cities is a grassroots, locally based, voluntary public/private partnership coordinated by the U.S. Department of Energy (DOE) that expands the use of alternatives to gasoline and diesel fuel. The goal of the Clean Cities program is to promote energy use in the transportation sector that is clean, safe, sustainable and less dependent upon foreign sources.

Public Service Commission of South Carolina (PSC)

PSC's principal duty is to hear cases involving the State's regulated utilities. The PSC has broad jurisdiction over matters pertaining to investor-owned electric and gas utility companies, water/wastewater companies, telecommunications companies, motor carriers of household goods, hazardous waste disposal and taxicabs. The South Carolina Office of Regulatory Staff is a party to all matters before the PSC.

South Carolina Environmental Excellence Program (SCEEP)

SCEEP is a voluntary program for companies committed to continuous environmental improvement to protect and preserve South Carolina's environment.

South Carolina Biomass Council

The South Carolina Biomass Council was created in April 2006 to develop a long-term strategy for biomass energy in the state. The council has compiled a set of policy recommendations intended to enhance biomass-to-energy opportunities, demonstration projects, grants and research. The South Carolina Biomass Council is a broad-based, diverse coalition of stakeholders ranging from government entities to private industry.

South Carolina Department of Health and Environmental Control (DHEC)

DHEC's Office of Environmental Quality Control (EQC) is the environmental regulatory division. EQC is responsible for the enforcement of federal and state environmental laws and regulations as well as issuing permits, licenses and certifications for activities, which may affect the environment. EQC is composed of four program areas:

Bureau of Water

Bureau of Air Quality

Bureau of Environmental Services

Bureau of Land and Waste Management

South Carolina Energy Office (SCEO)

SCEO, through the Plan for State Energy Policy, provides a broad range of resources designed to help citizens, businesses and public entities save energy — and money — through greater efficiency, better information and enhanced environmental quality. Since 1995, SCEO has helped save state citizens more than \$250 million through public and private energy-saving measures and new energy technologies. SCEO also promotes the use of renewable energies and sustainable development practices throughout the state and educates residential builders, inspectors, home owners and renters about building practices and behavioral changes leading to greater energy efficiency.

South Carolina Governor's Nuclear Advisory Council

The Governor's Nuclear Advisory Council is charged with advising the Governor on numerous issues pertaining to the nuclear industry in South Carolina, including the Atlantic Compact, the Barnwell commercial low-level radioactive waste disposal facility, the Savannah River Site and others.

South Carolina Institute for Energy Studies (SCIES)

SCIES is a state-chartered research and development organization established in 1981 and is housed at Clemson University. Its mission is to promote energy research and development in and for the state, transfer energy technology developed by others to South Carolina applications, contribute to national energy issues in areas of excellence and promote statewide energy education activities. To accomplish its mission, SCIES interacts with all departments at all colleges in South Carolina, state and federal agencies and private industry throughout the nation.

South Carolina Office of Regulatory Staff (ORS)

ORS is a state agency whose mission is to represent the public interest in utility regulation for the major utility industries — electric, natural gas, telecommunications and water/waste-water — before the PSC of South Carolina, the court system, the S.C. General Assembly and federal regulatory bodies. ORS also has responsibility for oversight of transportation, railroad and natural gas pipeline safety in South Carolina. In fulfilling its mission, ORS strives to balance the concerns of the using and consuming public, the financial integrity of public utilities and the economic development of South Carolina. For fiscal year 2007–2008, ORS generated a savings to customers of more than \$118 million.

South Carolina Sea Grant Consortium

The South Carolina Sea Grant Consortium is a state agency that, through research, education, extension and training, enhances economic opportunities and conservation of coastal and marine resources for South Carolina citizens.

South Carolina Solar Council

The purpose of the South Carolina Solar Council is to promote wide utilization of solar energy through such means as providing solar energy education, promoting the application of solar energy technologies and acting as a solar energy technologies expert resource for the people of South Carolina, thereby increasing public awareness of solar technologies and insuring its proper application. Additionally, the organization advocates for net metering and state policies that benefit solar technologies.

State Regulation of Public Utilities Review Committee (PURC)

PURC is responsible for nominating candidates for the Executive Director of the ORS and each seat on the PSC. PURC also conducts an annual performance review of each member of the Commission and the actions of the Commission. Additionally, PURC conducts an annual performance review of the Executive Director of ORS and an evaluation of the performance of ORS. Among other duties, the PURC assists in developing an annual workshop of at least six contact hours concerning ethics and the Administrative Procedures Act for the Commissioners and employees of PSC and the Executive Director and employees of ORS.

Weatherization Assistance Program (WAP)

This program provides home weatherization assistance for low-income families, particularly for the elderly, people with disabilities and children, by improving the energy efficiency of their homes. WAP is coordinated through eight community action agencies which are responsible for each of the state's 46 counties.

Wind Energy Production Farms Study Committee

This study committee was created to determine the feasibility of establishing wind energy production farms in South Carolina. This study committee is to report its findings and recommendations to the General Assembly by January 2010.

II.

Proposed federal mandates pose many risks for South Carolina, both economically and environmentally.

Any substantial taxes, fees or costs imposed on the production or burning of coal in this country will have a dramatic impact on South Carolina's utilities, economy and consumers. Any legislative or executive action should provide for consideration of current generation, the availability of affordable alternatives and the economic impact on a state or region's industry and citizens.

In addition to the above stated concerns regarding proposed federal legislation, our delegation should also be made aware of reports that the incoming Executive Administration may move quickly to curtail carbon emissions through new regulations. The President-elect may, for example, direct the Environmental Protection Agency (EPA) to begin regulating CO₂ as a "pollutant" under the Clean Air Act. This is possible because the United States Supreme Court ruled the EPA has the authority to do so in *Massachusetts v. EPA*, 549 U.S. 497 (2007). A reversal in this policy could have an immediate and substantial negative economic impact on South Carolina, in large part due to our public utilities' current reliance on coal generation.

South Carolina's electric generating facilities currently emit 46,960,295 tons of CO₂ annually. If companies are required to buy emission allowances for each ton emitted, the cost would increase exponentially. For example, if emission allowances were sold for \$30 per ton, South Carolina would be responsible for an additional \$1,408,808,850 in environmental costs per year. That equates to an increase of \$0.01564 per kWh generated. South Carolina's residents used an average of 1,195 kWh per month in 2007; this extra cost would lead to an estimated monthly increase of \$18.69 for an annual billing increase of approximately \$224.28 per household.

If the reduction of CO₂ emissions, however, is designed similarly to the reduction of sulfur dioxide (SO₂) under the Clean Air Act of 1990, each company may be given allowances for a certain percentage of what they emitted the prior year. Gradually, the allocation of emissions would be reduced until the emission allowances were reduced to the baseline year (1990 in this example). As the emission allowances are reduced, companies would either have to reduce their emissions to that level or purchase additional allowances.

Reviewing South Carolina and the baseline year of 1990, South Carolina would be given allowances for 22,188,357 tons of CO₂. If more than this allowance were emitted, then companies would have to purchase additional allowances to cover those emissions. Therefore, if South Carolina emitted 46,960,295 tons of CO₂ and were given allowances for 22,188,357 tons, they would have to pay for 24,771,938 tons in allowances. At \$30 a ton, South Carolina would be responsible for \$743,158,140 in environmental costs. Although costs would vary based on each utility's emission controls and generation mix, this would be an estimated increase of \$0.00825 per kWh generated. For the average residential customer using 1,195 kWh per month, the estimated increase would be \$9.86 per month, or approximately \$118.32 a year.



Based on the variances in the numerous proposed federal laws and regulations as well as uncertainties surrounding potential taxes or market costs and values, the exact cost to the South Carolina consumer cannot be accurately estimated. A variety of studies and speculations, however, estimate the immediate cost to be anywhere from an additional \$33.00 to \$600.00 per year for the average residential customer in South Carolina.

Additionally, if emission allowances are sold in an uncontrolled market, the cost per allowance could skyrocket, resulting in even higher rates. Therefore, any legislation authorizing an allowance trading program under a cap-and-trade mechanism should include “safety valve” components to ensure against pricing that would be detrimental to the country’s economy or unfairly place different economic burdens on different regions or states. Flexible safety valves should be administered by the EPA, such as is currently done for SO₂ emissions.

Regardless of design, any federal regulation of carbon emissions will result in South Carolina paying higher costs for its electricity, which will have a negative impact on its residents, businesses and industry.

South Carolinians currently benefit from the lower costs to generate electricity with nuclear and coal. Below is a comparison of the average costs to generate electricity based on various fuel sources. The cost for nuclear is a national average, while the remaining costs are specific to South Carolina.

Costs per fuel type

<i>Generation Type</i>	<i>Cents per kWh</i>
Nuclear+	2.1–5.0
Coal*	4.5–6.5
CCGT*^	5.5–11.0
Solar*	16.4–30.9
Wind*	11.9–15.6
Landfill Gas*	5.9–9.0
Biomass*	1.6–13.5

+Source: International Energy Agency

*Source: La Capra Study

^Combined Cycle Gas Turbine

III.

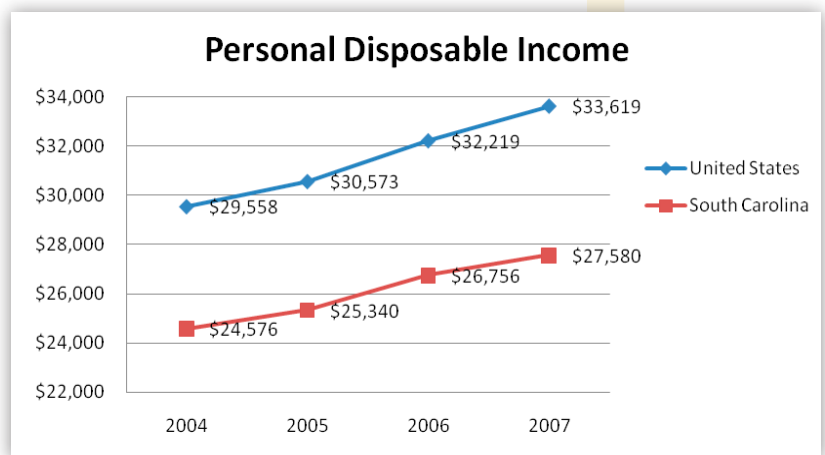
South Carolina has naturally entrenched disadvantages such as:

- 1. Demographics**
- 2. Electric Usage**
- 3. Location**

Demographics

South Carolina has a disproportionately low median income, heavy reliance on electricity and a growing population. According to the U.S. Census Bureau, the three-year average, median household income in the United States was \$49,740 from 2005 through 2007. South Carolina ranked 40th among the 50 states with a median household income of \$42,561.

Poverty and education must be factored in when considering energy efficiency. Based on 2007 U.S. Census Bureau data, South Carolinians rank 44th in the country with a personal disposable income of \$27,580 compared to the national average of \$33,619, which means South Carolinians have 18% less disposable income than the average American and thus would be disproportionately affected by increases in electric rates.



Additionally, those with less disposable income are less likely to be able to purchase new, energy-efficient appliances or make improvements to their homes that would increase energy efficiency. It is worth noting that, according to 2007 U.S. Census Bureau data, South Carolina leads the nation with 18.2% of its population residing in manufactured homes compared to the national average of 6.7%. That means South Carolinians are almost three times more likely to live in manufactured homes, which typically are not easily modified; therefore residents cannot easily make energy efficiency improvements such as adding insulation.

South Carolina, along with other Southern and Southwestern states, is expected to have a substantial increase in population over the next two decades. South Carolina is projected to have a 28.3% increase in population from 2000–2030 and become the 23rd most populous state with more than 5.1 million residents in 2030.

South Carolina also faces the challenge of having a very low literacy rate among residents. The Comprehensive Adult Student Assessment Systems measures the literacy characteristics of adults and breaks them into two levels. Level 1 identifies adults who typically cannot read well enough to read a simple story to a child or fill out a job application. Level 2 encompasses adults who can begin to compare and contrast but are unable to perform higher level reading

and problem-solving skills. Fifty-six percent of South Carolinians fall in level 1 or 2. In fact, South Carolina, along with Arkansas and West Virginia, has the 4th highest percentage of adults at level 1 or 2 in the country. This is important because if residents do not have basic reading and comprehension skills, the concept, implementation and benefits of energy efficiency are much more difficult to convey and understand. Any programs must be designed with this in mind.

As a result, the combination of South Carolina's low median income and high illiteracy rate are significant challenges to any effort to increase energy efficiency.

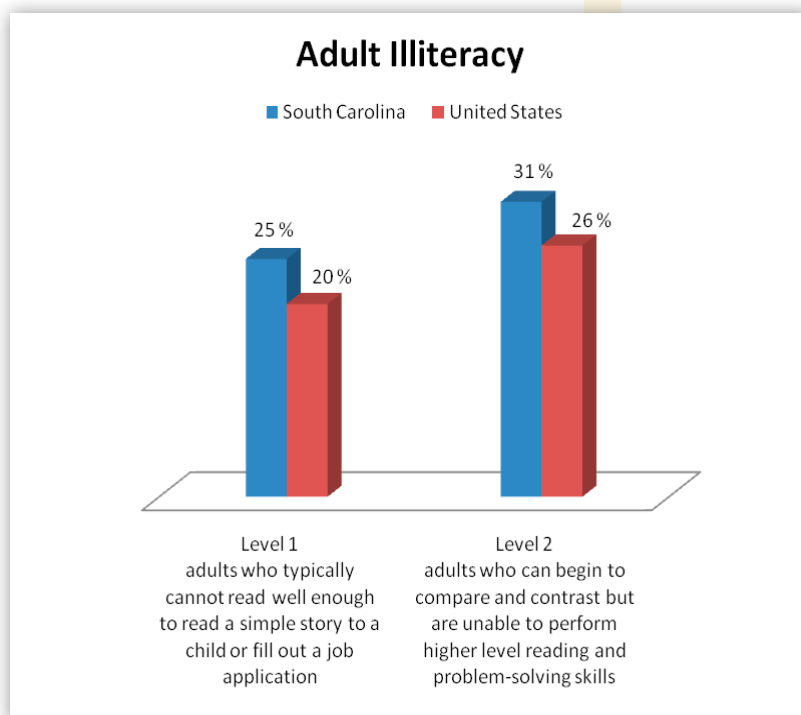
Electric Usage

South Carolina uses a disproportionate amount of electricity per capita. While the U.S. Census Bureau ranked South Carolina 25th in population in 2005, according to 2006 Energy Information Administration data, South Carolina residents have the 5th highest average monthly consumption (1,195 kWh per residential customer) and rank 10th highest in average residential electric expenditures (\$107.87 per month).

Hot, humid summers, relatively mild and short winters and poorly insulated structures of lower-income residents are three major reasons for the high electricity usage per capita.

Another reason for the higher electrical usage is that this state has an ideal climate for the operational efficiency of heat pumps. In fact, 61% of South Carolina residents use electricity as their primary energy source, compared to 32.5% nationally. While more northerly states have much greater numbers of homes heated with natural gas, fuel oil and, in certain rural areas, wood stoves or propane, there are few days with temperatures below the operational efficiency of heat pumps in South Carolina. Because heat pumps are the most energy-efficient heating systems in most parts of South Carolina, and are used by the majority of the residents in this state, it would be both extremely expensive and impractical to have residential customers replace existing systems with natural gas, propane or fuel oil furnaces.

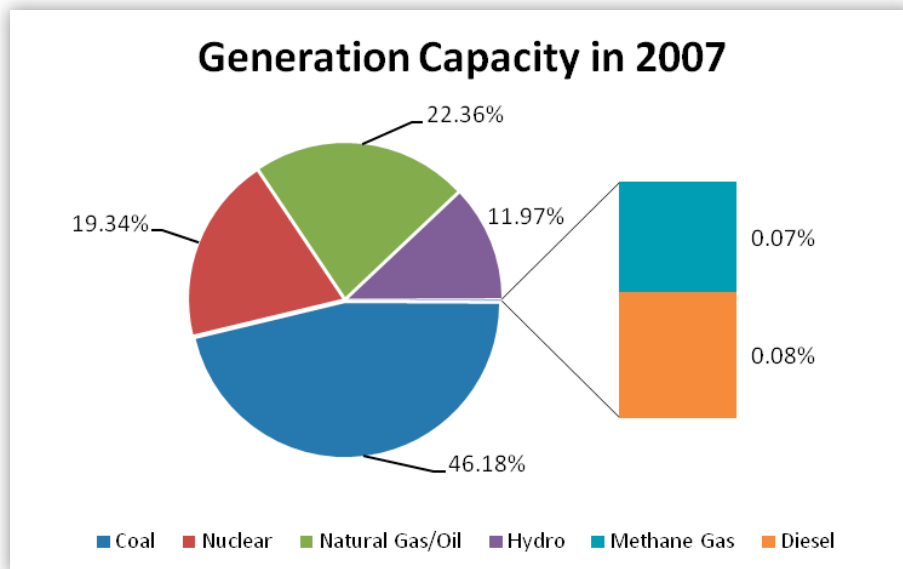
In addition to heating, electricity is used for air conditioning. There are many hot days in South Carolina, as suggested by the number of this state's "cooling degree days," a determination of energy demands for air conditioning. Cooling degree days are calculated by subtracting 65 from a day's average temperature. For example, if the day's average temperature were 80 degrees, the cooling degree days would be 15. South Carolina had an average of 1,877 cooling degree days, while Ohio averaged 794 during the same period. A higher number of cooling degree days typically leads to higher energy demands. South Carolina summers drive peak demand in summer months and this cannot be easily overcome.



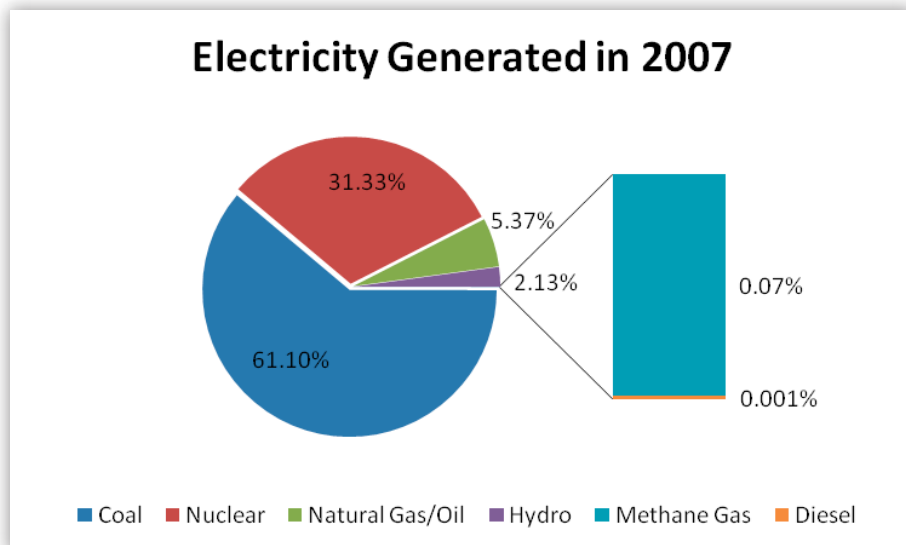
Also, like most other Southern states, the majority of South Carolina residents use electricity not only for heating and cooling, but also for heavy-use appliances such as dryers and water heaters. These are additional factors that contribute to the higher amount of electricity consumed by South Carolinians.

The high poverty level in South Carolina correlates to a large number of South Carolinians residing in energy-inefficient housing and using cheap, inefficient appliances. Residents are unable to purchase new, more expensive energy-efficient appliances or make improvements to homes that would increase efficiency. Additionally, lower-income residents tend to live in poorly insulated homes, which, even if smaller in square footage compared to other homes, use proportionately more electricity per square foot.

The following generation mix is calculated based on the generation capacity for South Carolina and represents allocation from multi-state companies. Generation capacity differs from the generation mix for South Carolina. Capacity is the total of all plants installed and able to generate electricity, if needed. Plants, however, are not continuously used — their usage is based on demand, operating and fuel cost. Therefore the following numbers represent the plants installed and available to generate electricity for South Carolina regardless of their use in 2007.



The following generation mix is calculated based on the electricity generated for South Carolina and represents allocation from multi-state companies. This differs from the generation capacity because this is what was actually used to generate electricity in 2007 rather than what is installed. Although a plant is installed and available, it is not always used for generation. Therefore the following numbers represent actual generated electricity for South Carolina customers in 2007.



Currently more than 61% of South Carolina's electricity is generated from coal. In general, coal-fired plants have an average life of approximately 70 years. South Carolina's coal-fired plants have an average remaining depreciable book life of 27 years. That means electric generating companies anticipate the plants being in service 27 more years for depreciation purposes. This also means there are 27 more years to pay for these plants, on average, which allows the cost of building the plant to be depreciated over those remaining 27 years. If any coal plant is taken out of service prior to the anticipated date, this depreciation schedule will be affected, causing these costs to be passed along to the consumer faster than originally planned and resulting in increased rates.

If a single 600 MW coal-fired plant were taken out of service in 2012 instead of its planned retirement at 2036, the depreciated life would be reduced from 27 years to 3 years. That would require the company to recoup additional depreciation expenses of \$160,000,000 in each of the remaining three years due to the extraordinary retirement of this coal plant. Based on 2007 generation, it is estimated that customers would be charged \$0.00265 per kWh, meaning an average residential customer using the 2007 monthly average of 1,195 kWh would be charged an estimated additional \$3.16 per month, approximately \$37.92 a year. If all of South Carolina's coal plants were retired prior to their depreciated book life, however, customers' bills would increase exponentially because of the high amount of electricity generated by coal in the state of South Carolina. The additional costs to replace that generation are not considered for the calculation of these numbers.

While coal still emits Greenhouse Gases (GHG), the electric generating companies that serve South Carolina have and continue to make substantial investments in making coal more environmentally friendly. Environmental equipment installed includes scrubbers, which reduce sulfur dioxide (SO₂), and Selective Catalytic Reduction (SCR) devices, which reduce nitrous oxide (NO_x). Reductions can be as high as 98%, depending on the equipment installed.

Through 2007, \$2,100,411,554 has already been invested in capital projects to reduce the emissions of coal, equating to an estimated \$0.00452 per kWh, costing approximately \$5.40 per month or nearly \$64.80 per year for the average residential customer using 1,195 kWh a month.

Through 2013, an additional capital investment of \$1,493,481,520 is planned resulting in an estimated \$0.00325 per kWh or approximately \$3.88 per month, about \$46.56 per year, for the average residential customer using 1,195 kWh.

Annually, South Carolina utilities spend \$55,709,833 to control emissions. Costs for emission controls are treated the same way as fuel costs and are passed along to the customer annually through fuel adjustments. For the average residential customer using 1,195 kWh, this cost is estimated to be almost \$9 per year.

When all capital and annual environmental costs are factored in, the estimated cost is more than \$0.00839 per kWh which is approximately \$10.03 monthly, an annual cost of about \$120.36 for residential customers using 1,195 kWh per month, which is more than a 9% increase in the average residential customer's bill. The above customer costs are estimates and actual costs will vary based on each utility's environmental controls and generation mix.

Based on this state's heavy reliance and investment in coal, this fuel source cannot be realistically taken out of the generation mix. More than 33% of South Carolina's electricity, however, is currently generated from GHG-free sources, including nuclear and hydroelectric, and this is estimated to increase to almost 52% within the next 20 years.

This increase in nuclear and renewables will advance this state and allow more than half of our electricity to be generated from GHG-free sources. In the meantime, any legislation should factor in South Carolina's generation mix and its residents to not create undue burden on the residents, businesses and industry of this state.

Location

Because of its location, South Carolina has limited renewable resources available for utility-scale generation. Unlike the western part of the country, solar is not a practical option and, unlike the Midwest, and some coastal areas, wind is extremely limited and only available offshore. There is a greater opportunity for agricultural by-products and landfill gas (LFG), but these are also limited resources and will not be sufficient to meet the growing needs of this state. That means we have fewer options and more reliance on conventional generating sources. South Carolina should not be substantially and adversely affected simply because of the lack of renewable resources compared to other parts of the United States.



IV.

Available Resources

As previously mentioned, coal is the leading fuel source for electricity generated in South Carolina. More than 61% of South Carolina's electricity comes from coal-fired plants. While these plants emit GHG, there is technology that has and will continue to be installed to reduce these emissions. The total capital investment through 2013 is estimated to be \$3,593,893,074 with more than half of that already spent. In addition, \$55,709,833 is spent annually on variable costs, such as reagents like lime or limestone, to reduce emissions. Unlike some parts of the country, carbon sequestration is not a viable option in South Carolina due to the lack of suitable geological formations in and around this state. Because South Carolina and many other states have a heavy reliance on coal and are not realistically able to change this in the near future, the technology to decrease these emissions must advance. To assist this progress, federal legislation should provide funds to be distributed to those investing in the research and development to control emissions.

South Carolina is third in the nation for installed nuclear capacity and is home to seven nuclear units. Because of the low fuel and operating costs associated with nuclear power generation, this state has lower electric rates than other parts of the country. There are plans to add additional nuclear generation to meet South Carolina's growing electric needs and, although the capital costs for nuclear are high, the low fuel and operating costs as well as the high capacity factor make this an attractive resource.

Since the generation of electricity with nuclear fuel is GHG-free, any potential legislation should allocate credits or allowances to those states generating electricity with nuclear power.

Another important part of South Carolina's generating mix is natural gas. This resource is primarily used for intermediate and peaking generation, meaning it typically only runs in times of higher demand. This is due to the higher generating costs and the quick-start ability to begin generating electricity faster than other resources such as nuclear and coal. While generating units fueled by natural gas can be built much faster than other types of generation with lower capital costs, the cost and availability of fuel tends to fluctuate dramatically.

A much smaller percentage (.07%) of renewable generation exists in South Carolina and is primarily derived from the combustion of methane gas from landfills. Electric generating companies in South Carolina anticipate 4% of the state's generation will come from renewables by 2027. To encourage more growth in this sector, however, there must be additional research and development. Therefore, federal legislation should provide funds to be distributed to those investing in the research and development of renewable resources.

Without improvements in technology, South Carolina is extremely limited in the availability of native renewable resources. The main sources of native renewables are biomass and landfill gas (LFG). To take advantage of renewable resources we must look outside of our state for this



type of energy. Other parts of the country have much greater access to renewable resources/energy, such as solar and wind, but for South Carolina to take advantage of those types of energy, we must transmit or bring the power in from elsewhere, which is expensive and not always feasible.

When it comes to renewable energy, however, South Carolina has made some progress. South Carolina is aggressively pursuing the development of renewable resources through programs such as PaCE and Santee Cooper and the Electric Cooperatives' Green Power Program.

Below is a listing of renewable resources and their availability for utility scale generation in South Carolina.

NOTE: Renewables are listed in no particular order. The La Capra study is the source unless otherwise noted. Quoted statements are from the La Capra study.

In September 2007, the results of a study prepared by La Capra Associates, Inc. ("La Capra") for Central Electric Power Cooperative, Inc. were released. This study focused on the renewable resources available in South Carolina. Technologies that were considered were various types of solar, onshore wind, offshore wind, tidal/wave, LFG, biomass co-firing and hydroelectric.

Of those resources available, the report broke them down into three categories: Commercial Technologies, Mature Technologies and Emerging Technologies/Resources. Once categorized, the report focused on commercial and mature technologies.

Commercial Technologies "have both technology and market maturity" and include:

Onshore wind
Landfill Gas
Biomass direct combustion
Small hydroelectric
Geothermal

Mature Technologies are those that "show promise for market expansion in the near-term." These include:

Anaerobic digester gas
Biomass co-firing
Crystalline silicon photovoltaic (PV)
Offshore wind

Emerging Technologies/Resources are those that are in development or pilot stages, and include:

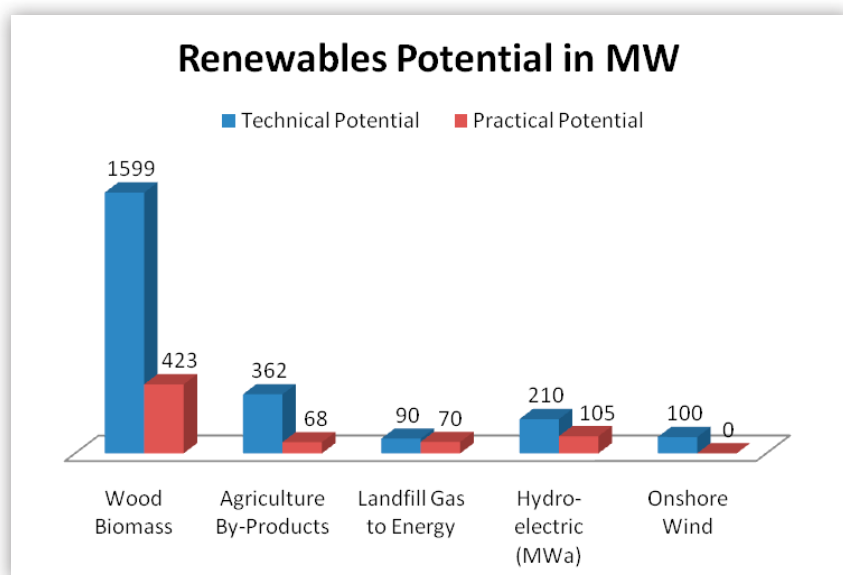
Tidal/wave
Concentrating PV
Power tower

Because Emerging Technologies/Resources are still in development, they were not studied in this report.



According to the La Capra study, South Carolina has the technical potential of new in-state renewable resources totaling about 2,360 MW. The technical potential is made up of those technologies that are commercial, or mature, and located in the state with the potential for electric generation. Offshore wind, solar and ocean power resources were not estimated because, “various factors currently limit their development, even though the resources themselves may be abundant.” Despite these numbers, the study states that within the next decade, the practical potential — which might reasonably be expected to be implemented — is up to 665 MW. This differs from the technical potential, which refers to potential generation in ideal circumstances, because realistic conditions are taken into account.

The following is a summary of the renewable resources available in South Carolina:



*Hydroelectric potential is measured in average MW based on annual mean flow rates or estimated annual production.

Landfill Gas to Energy (LFG)

As waste decomposes, gases are produced. The majority of those gases are methane and carbon dioxide. According to the EPA, “landfills are the second-largest single human source of methane emissions in the United States, accounting for nearly 34% of all methane sources.” The EPA requires large landfills to remove these gases through a flaring process. An alternative to flaring is capturing these gases and using them in a manner similar to combusting fossil fuels. The most common technology used to generate electricity from landfill gas is a reciprocating engine or internal combustion engine (ICE).

South Carolina currently has 24 MW of installed LFG capacity. Nationwide there are 1,250 MW installed. LFG is most likely the lowest-cost renewable energy option in South Carolina and there is an opportunity for generation at most of South Carolina’s municipal solid waste landfills. There could, however, be competition with the landfills who would like to use the electricity for their own use.

According to the South Carolina Energy Office's report, "Biomass Energy Potential in South Carolina," there are plans to add up to 45 MW of LFG generation. Current locations include:

Horry County Landfill Generating Station near Conway — 3 MW.

Lee County Landfill (Allied Waste) — 5.4 MW. The project will expand to 10.0 MW in 2009 and 14.5 MW in 2012.

Screaming Eagle Road Landfill (Waste Management) in Richland County — 5.5 MW. Another 1.6 MW engine will be added in 2009 and 2011 to produce a total of 8.7 MW on site.

Anderson Regional Landfill in Richland County — anticipated capacity is 3.2 MW to be installed in late 2008.

Georgetown County Landfill — anticipated capacity is 1.6 MW to be installed in 2009.

In addition to these facilities, there are several private companies utilizing LFG:

BMW's South Carolina car assembly plant and paint shop use LFG and almost 70% of their energy consumption comes from LFG. According to BMW, this eliminates the carbon dioxide emissions equivalent to driving 105 million miles per year, or more than 4,000 times around the earth.

MethaneCredit is developing a project that will sell the LFG from Greenwood County Landfill to Fuji Film. It is expected to generate up to 60% of the energy needs at Fuji Film's manufacturing plant in Greenwood and is expected to be complete in late 2008.

Kimberly-Clark is planning to purchase LFG from Three Rivers Solid Waste Authority in Aiken County.

South Carolina's LFG Potential:

Technical Potential: 90 MW

Practical Potential: 70 MW

With any type of generation, the capacity factor must be considered because it is vital for generation planning. Additionally, costs must be evaluated because it allows companies to make decisions based on the cost and reliability of generating sources.

	Capacity Factor	Average Installed Cost – 2006 \$/KW	Fixed Operating & Maintenance Cost – 2006 \$/KW	Variable Operating & Maintenance Cost – 2006 \$/KW
>5 MW	80–85%	\$1,750	\$100	\$12
<5 MW	80–85%	\$2,500	\$100	\$12

These numbers are comparable to other types of baseload generation. On average, nuclear has a capacity factor of 90% and coal is 73%. Source: Energy Information Administration, *Electric Power Annual*, 2007 (2006 data)

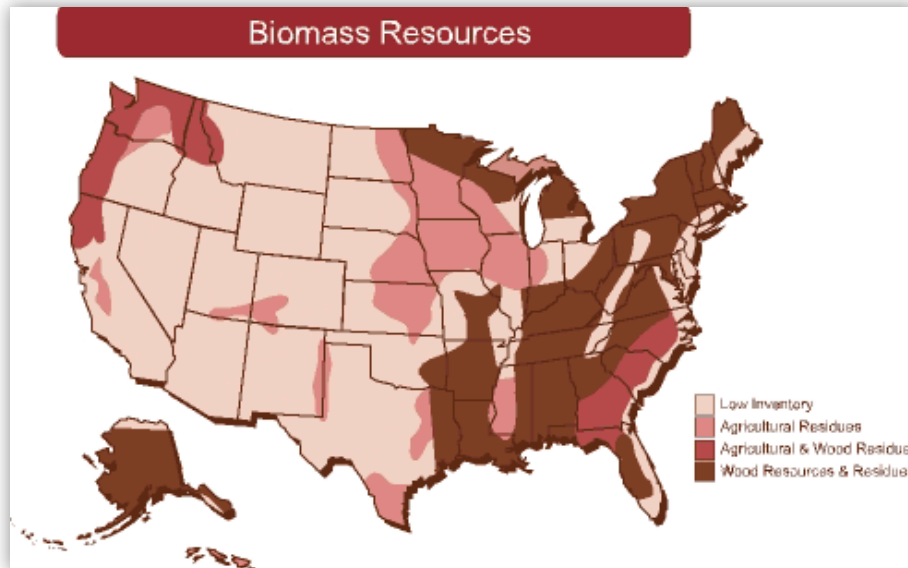
Wood Biomass

There are various ways to take advantage of wood biomass. The three mature technologies available in South Carolina are direct-fire, co-firing in coal plants and fluidized bed. Direct-fire is similar to fossil-fuel-fired power plants. The wood is combusted in a boiler to produce high-pressure steam, which causes a turbine to rotate. This turbine is connected to an electric generator so that as the turbine rotates the generator turns and produces electricity. Co-firing is very similar, but it involves adding wood to a coal-fired power plant. Therefore coal and wood are combusted together in the boiler, which typically leads to lower emissions. By utilizing a fluidized bed, solid fuels are elevated by air during the combustion process. The result is a mixing of gas and solids, which generally burns cleaner than solids alone.

Through these three technologies, the La Capra study states that South Carolina has 1,599 MW of technical potential while the practical potential is 423 MW. Nationally there is 5,890 MW installed capacity, including the 360 MW installed capacity in South Carolina.

	Capacity Factor	Average Installed Cost - 2006 \$/KW	Fixed Operating & Maintenance Cost — 2006 \$/KW	Variable Operating & Maintenance Cost — 2006 \$/KW
Direct-fire	80–85%	\$2,700	\$75	\$10
Co-fire	70–75%	\$75–\$230*	\$12	\$5
Fluidized bed	80–85%	\$3,000	\$75	\$10

**Higher cost is for retro-fitting a coal plant to accommodate higher amounts of biomass.*



Agricultural By-Products

There are several sources of energy that fall under agricultural by-products including agricultural crop residue, poultry litter and swine waste. These products would be co-fired or directly fired like wood waste. The exception is swine waste, which would use an anaerobic digester. Although agricultural by-product resources may be abundant, few have practical applications in South Carolina due to varying reasons.

Crop residue is left in the fields after harvesting. Typically it is plowed back into the soil or burned after the harvest. Of the crops in South Carolina, corn is the only viable option for co-firing. It is currently being considered as a co-fired fuel source with coal or other biomass. Nationally there is less than 75 MW installed and there is currently no installed capacity in South Carolina.

Another agricultural by-product is poultry litter. DHEC reports that there are 516 permitted poultry facilities and 181 permitted turkey facilities in South Carolina. Poultry litter can be used in co-firing with wood or coal, or used for direct fire. Although this is a viable option, consideration must be given for increased ash, emission requirements and the potential value for use as a fertilizer.

The last viable agricultural by-product in South Carolina is swine waste. For swine waste to be effective for electric generation, AgStar (EPA) recommends facilities with greater than 2,000 heads for anaerobic digesters. For the operation to be cost effective, however, it is estimated that more than 5,000 heads would be needed. There are very few swine operations in the state with large enough herd sizes to make this generation a viable option. There are currently 900 hog/swine farms in South Carolina — only 37 have more than 2,000 head and 21 have more than 5,000 head. This greatly limits the potential for swine waste.

		<i>Technical Potential</i>	<i>Practical Potential</i>	<i>Capacity Factor</i>	<i>Average Installed Cost— 2006 \$/KW</i>	<i>Fixed Operating & Maintenance Cost—2006 \$/KW</i>	<i>Variable Operating & Maintenance Cost—2006 \$/KW</i>
Agricultural Crop Residue		176 MW	36 MW	85%			
	<i>Direct Firing</i>				\$2,700	\$75	\$10
	<i>Co-firing</i>				\$75–\$230*	\$12	\$5
Poultry Litter		42 MW	31 MW	85%			
	<i>Direct Firing</i>				\$2,700	\$75	\$10
	<i>Co-firing</i>				\$75–\$230	\$12	\$5
Swine Waste		2 MW	1 MW	75%	\$4,000	\$270	\$-12

*Higher cost is for retro-fitting a coal plant to accommodate higher amounts of biomass.

Hydroelectric

The United States has been successfully harnessing the power of water for electric generation for more than 100 years. Since most large hydroelectric options are currently being utilized, the focus has now shifted toward developing smaller projects. In South Carolina there is approximately 3,400 MW of installed capacity. Nationally, there is 78,700 MW installed. Currently, there are estimated to be 45 small hydroelectric locations in South Carolina, but only 15 are deemed practical for development. These are run-of-river projects that do not use a dam, but use the natural flow of the river. Consideration must be given to the lack of storage of energy (in this scenario the water is not dammed, therefore it is unable to produce electricity as needed) and natural changes in the availability of energy (in dry seasons there will be less power to harness and more in the wet season). Additionally, there are 14 low-power (conventional) hydroelectric sites that might be available for development.

Technical Potential:

*210 MWa**

Practical Potential:

*105 MWa**

	Capacity Factor	Average Installed Cost—2006 \$/KW	Fixed Operating & Maintenance Cost—2006 \$/KW	Variable Operating & Maintenance Cost—2006 \$/KW
Conventional	25–35%	\$2,000	\$12	\$3
Small Hydroelectric	25–35%	\$3,000	\$20	\$5

*Hydroelectric potential is measured in average MW based on annual mean flow rates or estimated annual production.

Solar Energy

The technology behind solar is continually changing but two technologies that are mature are photovoltaic (PV), which uses flat panels consisting of silicon-based material that converts energy from the sun into electricity, and concentrating solar power (CSP) or high concentration photovoltaic (HCPV). The terms CSP and HCPV refer to systems which use a reflective material that focuses the light onto PV. These resources allow for increased electricity to be generated from a smaller amount of PV. Nationally, there is approximately 500 MW of installed capacity, but there is only about 1 MW of installed capacity in South Carolina.

The most recent development in large-scale solar electric generation is called thermal solar, which uses mirrors to focus sunlight on tubes filled with water or synthetic oil to generate steam that then turns a turbine to produce electricity. This emerging technology, which is an advancement in CSP/HCPV technology, offers the greatest potential for large-scale generation, but is impractical for use by homeowners or small businesses. Numerous thermal generation plants have been recently completed or are currently under construction in Nevada, Arizona and California. The largest solar generation facility in the United States is the SEGS facility in California's Mojave Desert, which has a combined 354 MW of generation capacity from its nine solar plants. This facility contains more than 900,000 mirrors and covers more than 1,500 acres of

desert. Despite the large capacity, the facility includes a natural gas “back-up” to allow the generators to produce electricity during peak demand times, when solar output drops, and at night.

To efficiently take advantage of solar power, panels must be located in an area with high solar radiation. South Carolina receives 4.0–6.0 kWh/meter²/day,* which is lower than the recommended 6.75 kWh/meter²/day. ••

**Source: Department of Energy*

••Source: The La Capra report prepared for SC Electric Cooperatives

This does not necessarily mean that solar is not an option in South Carolina. But, the lower the solar radiation, the less effective solar panels are at generating electricity. Consideration must also be given to the availability of electric generation from sunlight as it is not constant. Obviously, alternative generation must be available in the evening. Additionally, generation must be available if there is cloud cover and no viable sunlight.

Currently, there is no utility scale battery storage for solar — the resource can only be used when it is available, which is not necessarily when the power is needed. Therefore, the possibility of the resource not meeting the demand must be considered. In July 2008, MIT announced it had begun developing technology to store solar energy on a large scale. However, this technology is not expected to be available until at least 2018.

Solar is readily available in the western part of the United States, but transmission losses to South Carolina are significant. Also, availability is limited because of the design of the nation’s transmission systems. The United States has three different interconnected transmission systems. When these systems were built, they were designed to transmit the peak load of each company with small amounts being transmitted from one system to another. They were not designed to transmit large amounts of electricity from one part of the country to another. Due to these constraints, electricity can be generated in Texas but cannot be easily transmitted and placed on the grid in South Carolina.

Additionally, dispatchability must be considered. With conventional generating units, you can increase or decrease the generation based on needs. You do not have this option with solar. The panels generate electricity when the sun is shining and you do not have control over how little or how much is being generated.

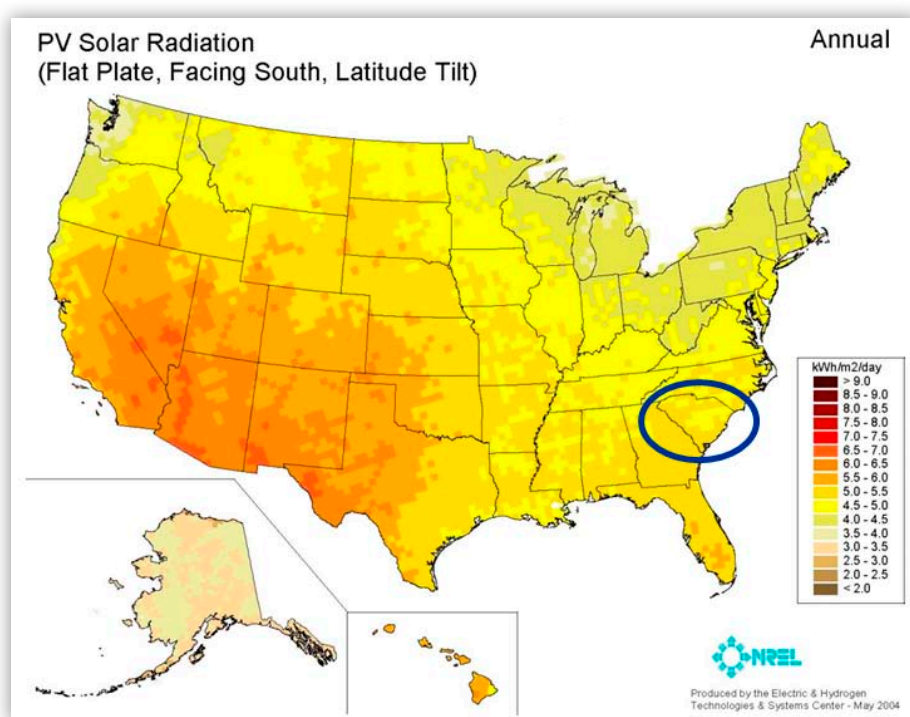
Cost is another factor when considering solar generation. The average installation costs for a utility-scale solar PV system is \$4,000 per KW (in 2006 dollars), which makes it one of the most costly installations for South Carolina. Plus, because the sun is not always shining, the capacity factor for solar in South Carolina ranges from 19% to 21%. At this capacity factor it would take four to five times as many solar PV panels located in different places with more



sun to equal 100% capacity when compared to conventional baseload generating plants, such as nuclear or coal.

Technical and practical potential were not evaluated by the La Capra study because “available technologies have not achieved maturity or permitting issues introduce uncertainties for estimate.”

	Capacity Factor	Average Installed Cost—2006 \$/KW	Fixed Operating & Maintenance Cost—2006 \$/KW	Variable Operating & Maintenance Cost—2006 \$/KW
Utility Scale	19–21%	\$4,000	\$15	unknown
Commercial	19–21%	\$6,000	\$30	unknown
Residential	19–21%	\$8,000	\$50	unknown



Wind Energy

In recent years, an increasing amount of attention has been paid to generating electricity through wind energy. Technology has allowed us to capture the wind's power and generate electricity. Nationally, there is 11,700 MW installed but there is no installed capacity in South Carolina.

Based on several wind studies, South Carolina is very limited in terms of the availability of wind and it has been concluded that there are no available onshore wind resources in South Carolina. The only potential resources are offshore, but currently there are no offshore wind projects in the United States. Based on the National Renewable Energy Laboratory (NREL), South Carolina has potential for offshore wind, but the best options are more than 10 miles off the coast. After 3 miles, however, the waters are considered federally owned and therefore siting would require state and federal approval. Additionally, there are increased costs the farther from land you place wind turbines. The electricity must be transmitted back to land through underwater transmission lines. Underwater transmission costs are much higher than the estimate of \$1 million a mile for onshore transmission. Because of the higher costs, projects closer to land would be more feasible and cost effective.

NREL calculated that the initial cost of a 3 MW offshore turbine in 2005 dollars would be \$6,386,000, which translated into an installed cost of \$2,129/KW. To serve a load of 1,200 MW reliably would take 1,173 turbines. At a cost of \$6,386,000 per turbine, the total cost would be \$7,490,778,000 or \$6,242 per KW. This cost does not include any additional transmission costs. Costs for integrating wind into transmission are estimated to be an additional \$0.002-\$0.005/kWh, according to a U.S. DOE 2008 study.

The capacity factor for wind is lower than many other conventional resources. According to AWS Truewind, the capacity factor within 10 miles of the South Carolina coast is 30–35%. This is lower than in other parts of the country and lower than conventional generation such as nuclear, coal or natural gas. Because the wind is not constantly blowing, the electricity generated is not dispatchable, which must be considered for utility-scale projects. There will need to be a back-up method of electricity generation for those times when the wind is not blowing. There is no utility-scale battery storage for wind so the resource can only be used when it is available, which is not necessarily when the power is needed. The possibility of the resource not meeting the demand must be considered.

Wind is a viable option in the Rocky Mountains, Midwest and along parts of the East coast of the United States. Again, transmission from other parts of the country proves to be very difficult because of the aforementioned transmission constraints.

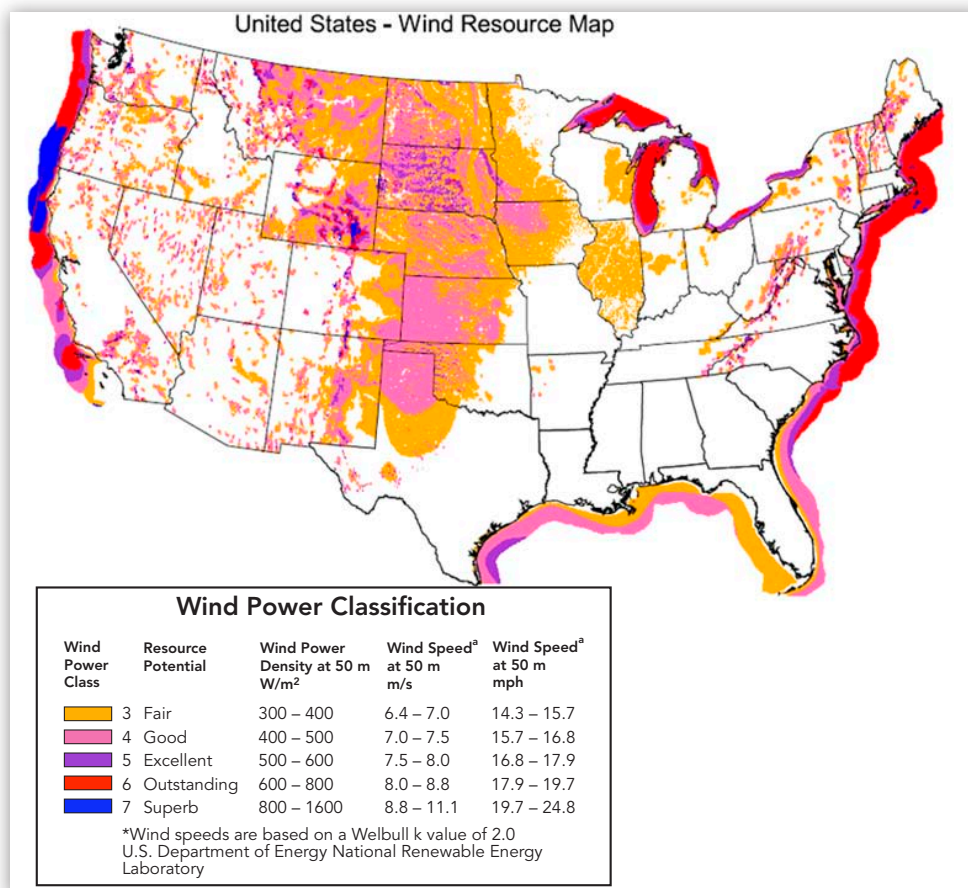


Consideration must also be given for the durability of the turbines during storms, especially hurricanes. According to GE Wind, their turbines are designed to withstand 130 mph winds, which is equivalent to a Category 3 hurricane. In the last 150 years, South Carolina has experienced two Category 4 hurricanes.

Cost, technology and availability are the greatest barriers for wind generation in South Carolina. As technology improves, the costs will hopefully decrease, making this a more realistic option for South Carolina.

Technical and practical potential were not evaluated by the La Capra study because “available technologies have not achieved maturity or permitting issues introduce uncertainties for estimate.”

	Capacity Factor	Average Installed Cost—2006 \$/KW	Fixed Operating & Maintenance Cost—2006 \$/KW	Variable Operating & Maintenance Cost—2006 \$/KW
Offshore	30–35%	\$2,800 (does not include transmission costs)	\$80	\$2



Energy Efficiency/Conservation

South Carolina also uses energy efficiency (EE) and conservation as a part of its generation mix. South Carolina has higher electric usage per capita than many other states. While some causes for this cannot be changed, this state can do more to reduce its usage. Increased awareness of conservation and energy efficiency is just the beginning for South Carolina. A collaboration of numerous governmental and private entities should be encouraged to create innovative solutions to decrease the usage in this state while making the solutions affordable to all South Carolinians. Because South Carolina has a disproportionate number of lower-income residents, energy efficiency might not be a realistic option for some due to the upfront costs. Therefore, any legislation should offer concessions or allowances for lower-income households, who would bear the greatest burden of any increase in the costs of electricity associated with a carbon cap-and-trade program.

As previously mentioned, the population of South Carolina continues to grow and, by 2030, estimates show that South Carolina will be the 23rd most populous state in the country due to an estimated 28.3% increase in population from 2000–2030 resulting in an additional 1 million-plus residents.

Furthermore, the increase of electronics in homes and businesses is driving the higher demand for electricity. By 2023, electric generating companies serving South Carolina plan on adding almost 5,000 MW of generation resources, exclusive of the effects of demand-side management (DSM), to meet the increase in demand of approximately 4,900 MW in this state. Along with the increased generation, the companies and ORS are encouraging energy efficiency and conservation. Almost 1,000 MW of DSM are expected by 2023. Between the DSM and additional generation, South Carolina will have a reserve margin in 2023 of 15.9%. If DSM does not work as planned and South Carolinians do not respond to energy efficiency and conservation, however, the reserve margin drops to 10.8% in 2023. The reserve margin is a very important number because it states the amount of available capacity of the power system above its anticipated peak load. Desirable reserve margins range from 12–18% of normal capacity to allow for unforeseen situations, such as an increase in demand or unscheduled maintenance.

As stated before, almost 5,000 MW of additional generation resources are planned for South Carolina to meet the growing demand. If this generation is not constructed, South Carolina is facing substantial shortages in electricity which could hinder economic development in this state. Without the increase in generation, South Carolina's reserve margin falls below 12%, becoming unacceptable in 2011 and the state will be facing blackouts in 2019. If DSM efforts are unsuccessful, electric shortages will occur more quickly. Without added generation and successful DSM, South Carolina will have a reserve margin below 12% in 2010, and will be facing power shortages and probable blackouts in 2016, if not earlier.

To meet the increasing demand in South Carolina, there is no one solution. Based on this state's heavy reliance and investment in coal, this fuel cannot be realistically removed from the generation mix. Increased nuclear and renewables, however, will advance this state and allow more than half of our electricity to be generated from GHG free sources. In the meantime, any legislation should factor in South Carolina's current generation mix, historical emissions and its residents to not create undue burdens on the residents and businesses of this state. For the economic development and progress of this state, electricity must be reliable and affordable for all the citizens of South Carolina.

V.

Even though most utilities have DSM programs, promote energy efficiency, encourage load management and even use some renewable energy resources, change must occur if South Carolina is to remain both environmentally and economically sound.

DSM involves modifying energy use to maximize efficiency. In contrast to supply-side strategies, which increase energy supplies by, for example, building new power plants, DSM strives to get the most out of existing energy resources, thereby postponing the need for new power plants. Additionally, cost savings to customers and reduction of pollution are indirectly achieved through DSM.

Of the 46 electric utilities, 31 had active DSM programs in 2007.

Based on 2007 DSM activity reported to the South Carolina Energy Office, the state's utilities are continuing their DSM activities, and;

At least two utilities plan to significantly expand their EE and DSM program offerings.

Other utilities reported that conservation and energy efficiency have a much greater potential to meet electric needs in South Carolina than do alternative or renewable energy resources, and these are the fastest, most economical and customer-friendly way to meet goals.

Examples of on-going DSM activities fall into various categories, as outlined below.

Conservation

Conservation is designed to entice consumers to use less electricity through changes in working and living habits, thereby reducing their overall need for electricity. Included in this category are public education and awareness programs that promote energy-reducing activities such as maintaining conservative thermostat settings, turning off appliances when not in use, installing low-flow showerheads and replacing incandescent bulbs with compact fluorescent bulbs (CFLs).

It is difficult to quantify the results of any one program, but many electric suppliers continue to conduct energy awareness advertising campaigns, demonstrations and seminars for various classes of customers.



Energy Efficiency

Energy efficiency programs reduce energy consumption by encouraging consumers to use energy more efficiently. There are many programs available, and each program is intended for a specific group of electricity users. Some of the targeted groups are newly built residences, existing residences, industry, commercial buildings and agricultural users. These programs promote the use of more effective building insulation, high-efficiency industrial equipment, appliances, air conditioning equipment and lighting. Incentives consist of more favorable rate schedules, cash rebates, low-interest loans and technical assistance.

Load Management

Demand-side activities in this category reduce the instantaneous demand for electricity by limiting or discouraging use during periods of high demand. For many reasons, it typically costs more to supply power during peak periods. Some older, less-efficient generating plants are primarily used to meet peak demand. Furthermore, other newer facilities are typically only brought online during peak times because they use more expensive fuel such as natural gas. Therefore, transferring the use of electricity to periods of lower demand allows the electricity to be generated and distributed using more efficient, baseload generating plants. Typical load management activities include allowing direct, remote control of air conditioners and water heaters, interruptible rate schedules for large customers, thermal energy storage systems using off-peak power and time-of-use rates.

Standby Generation Programs

Standby generation programs provide incentives for customers owning standby generators to utilize them during periods of high demand, thereby reducing the system peak demand. The requirements for these programs vary, but there is usually a payment from the electric company for the amount of capacity that is displaced by the generator as well as a fuel supplement payment based on kWh. Most suppliers require participants to have a minimum-size generator as well as an agreement regarding its operation.

Voltage Reduction

Voltage reduction programs reduce the supplied voltage of electricity to all customers, usually between 2% and 5%. Lowering the supplied voltage has the overall effect of reducing the demand for electricity. There is some controversy concerning the effects of this practice, and, as a result, it is used primarily as a last resort before interrupting the supply of electricity. Some municipalities employ this practice for reducing the load during critical periods, thereby reducing the peak demand and electric consumption for all customers in each sector.

Additional DSM and energy efficiency activities by the state's utilities could be spurred by rate structures, which allow utilities to profit from energy efficiency, as they currently do from building new plants and selling electricity. Energy efficiency for homeowners could be significantly enhanced if consumers were able to obtain very low-interest loans for energy improvements such as efficient appliances and HVAC systems.

VI.

Recommendations to create an economically and environmentally responsible energy future for South Carolina.

Based on overall analysis of the information and data reviewed in this report, ORS recommends the state of South Carolina advocate the following principles:

- › Ensure there is reliable, reasonably priced electricity for its citizens. South Carolina has enjoyed relatively low electricity prices, due in large part to the prudent reliance on lower-cost nuclear and coal generation.
- › Acknowledge that all resource options must be preserved to meet resource needs. Coal will need to continue to play a role in meeting consumer electric needs. However, the state should encourage investment in cost-effective energy efficiency and renewable resources.
- › And, should the Federal government choose to take action to address the issue of global climate change, its actions should protect the environmental and economic interests of the citizens of South Carolina. In particular, this legislation should:
 - ›› Address all greenhouse gas (GHG) emissions from all sectors, including transportation and electric generation.
 - ›› Utilize a cap-and-trade methodology as opposed to a tax.
 - ››› A tax provides a price signal related to the emission of carbon but does not ensure a cap on the level of emissions.
 - ››› The use of the revenues from a tax is uncertain. The federal government could potentially use the revenues for purposes that have no relationship to limiting GHG emissions.
 - ››› A cap-and-trade methodology establishes a cap on emission levels and allows trading of emission allowances.
 - ››› A cap-and-trade methodology is a proven system.
 - ›› Reduce emission levels gradually over time, allowing for the development of technologies to reduce emissions.
 - ››› If the emission levels are reduced too rapidly, it may be difficult to achieve the emission reductions and the cost to achieve the levels could be harmful economically.
 - ›› Include protections such as a safety valve for allowance prices, against unacceptable detrimental economic impacts and address the special needs of lower-income citizens.
 - ›› Provide for funds to be distributed to those investing in research and development of renewable resources and the reduction of emissions.

- » Provide for funds to be distributed to lower-income households to assist with the purchase of energy efficient appliances and to assist with their monthly electric bill.
- » Consider nuclear power generation a “GHG emission neutral” source of electricity and electric utilities, state or regions utilizing nuclear power generation should be allocated corresponding credits or allowances.
- » Include credit for carbon “sinks,” such as forests.
- » Provide for the development of technologies, which can be employed to reduce national GHG levels. Specifically, federal legislation should encourage the development of new nuclear generation through the expansion of federal loan guarantees and production tax credits.
- » At least initially, the allowances associated with a cap-and-trade system should be allocated as opposed to an auction of allowances.
 - » Allocations should be based on some historical baseline emission level over several years. The allocation of allowances could be ratcheted down over time as the emissions cap is lowered over time.
 - » Full auction of allowances raises the same issue as a tax related to the revenues that are raised.
 - » Full auction also unfairly penalizes utilities for past prudent decisions such as the decision to build coal plants.
- » South Carolina should act to implement economic incentives to attract private investment in the research and development of renewable energy and the construction of renewable energy generation facilities both for its current utilities and potential investors in South Carolina’s economy. Biomass should be considered as a renewable energy resource.

Quite simply, we must work to ensure the actions the federal government might take do not become the largest, unfunded federal mandate in the history of South Carolina.

Glossary of Terms

Anaerobic Digester

Anaerobic digestion, a naturally occurring process, is the bacterial breakdown of organic materials in a system that does not include oxygen. One example is using this digester to break down animal waste, which creates methane that can be used to generate electricity.

Baseload Generation

Generation which is used to meet the ongoing and steady energy needs of customers. This generation typically has a capacity factor of 60% and above and usually uses a fuel source such as coal or nuclear.

Biomass Co-Fire

Generation which involves replacing a portion of fossil fuels, such as coal, with biomass resources, such as wood, to generate electricity.

Biomass Direct-Fire

The combustion of biomass resources, such as wood, to generate electricity.

Capacity Factor

This is an important characteristic when considering types of generation. This is used to measure the productivity of power plants. It is determined by taking the amount of power produced and dividing it by the amount that would have been produced if the plant operated 100% of the time.

Carbon Dioxide (CO₂)

A colorless, odorless, tasteless gas, which is about 1.5 times as heavy as air. Under normal conditions, it is stable, inert and nontoxic. The decay of all organic materials produces CO₂. Fresh air contains approximately 0.033% CO₂ by volume. In the respiratory action (breathing) of all animals and humans, CO₂ is exhaled and growing vegetation naturally absorbs CO₂.

Carbon Sequestration

The capture of carbon from a generating source and subsequent storage underground in deep geological formations.

Carbon Sink

A reservoir of carbon that accumulates and stores carbon for an indefinite period. The main natural sinks are the world's oceans and forests, which use plant photosynthesis to absorb CO₂. Forests and other land areas with dense plant populations qualify as carbon sinks under the Kyoto Protocol.

Concentrating Photovoltaic (PV)

A photovoltaic system that focuses solar rays on a photovoltaic cell to increase efficiency of conversion into electricity.

Conservation

Using less electricity through changes in working and living habits. Ideally this results in a constant reduction in the need for electricity. Examples include turning off lights, switching to CFLs, adjusting thermostats or decreasing the temperature of water heaters.

Cooling Degree Days

A method used to determine the energy demands of air conditioning. The Cooling Degree Days are calculated by subtracting 65 from a day's average temperature above 65 degrees F.

Crystalline Silicon Photovoltaic (PV)

A type of PV cell made from silicon and used to convert sunlight into electricity. Crystalline silicon was the material used in the earliest successful PV devices and is still the most widely used PV material.

Demand-Side Management

The modification of energy usage to reduce peak load and get the most out of current generation resources.

Dispatchable

Refers to the ability of electric generators to respond to changes in system demand or to respond to transmission security constraints. If a plant is dispatchable then the generating company can increase or decrease the amount of electricity generated as needed.

Disposable Income

The amount of income left to an individual after taxes have been paid, available for spending and saving.

Emission Allowances

Typically administered by the EPA, allowances are given as permission to emit a certain quantity of particulates at a certain price. These allowances can be sold in a regulated market.

Energy Efficiency

Reducing energy consumption through adjustments such as increasing insulation, installing new windows or utilizing appliances that use less electricity.

Fixed Operating and Maintenance Costs (O&M)

The annual costs attached to the ownership of property such as depreciation, taxes, insurance, and in some instances, rents, general and administrative expenses and necessary regular maintenance.

Flaring

Removing gas, such as methane gas in landfills, by burning the escaping gas.

Fluidized Bed Combustion

Elevating solid fuels, such as wood or coal, by air during the combustion process. The result is a mixing of gas and solids, which generally burns cleaner than solids alone.

Geothermal Energy

Hot water or steam extracted from the Earth's geothermal reservoirs. This can be used for geothermal heat pumps, water heating, or electricity generation.

Geothermal Plant

Utilizing the hot water or steam located in the Earth's geothermal reservoirs to generate electricity.

Greenhouse Effect

The increasing mean global surface temperature of the earth caused by gases in the atmosphere (including carbon dioxide, methane, nitrous oxide, ozone, and chlorofluorocarbon). The greenhouse effect allows solar radiation to penetrate but absorbs the infrared radiation returning to space.

Greenhouse Gases (GHG)

Components of the atmosphere that contribute to the greenhouse effect. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. The majority of greenhouse gases come from natural sources but are also created by human activity.

Heating Degree Days

A method used to determine the energy demands of heating on those days with an average temperature below 65 degrees F. The Heating Degree Days are calculated by subtracting the day's average temperature from 65.

Installed Cost

The total cost of building a new electric generation plant.

Interconnection

A connection between two electric systems permitting the transfer of electric energy in either direction.

Intermediate Generation

Generation which is used to meet the demands that are higher than the ongoing, baseload demands. This generation typically has a capacity factor ranging from 20–60% and often uses a fuel source such as coal or natural gas.

Kilowatt (KW)

One thousand watts (See watt)

Kilowatt hour (kWh)

One thousand watt-hours. (See watt-hour) This is the unit of measurement for residential customers.

Landfill Gas

Gas that is generated by decomposition of organic material at landfills. The average composition of landfill gas is approximately half methane and half carbon dioxide. The methane in landfill gas is removed by, among other things, venting, flaring or combustion to generate electricity.

Load Management

Reducing the instantaneous demand for electricity by limiting or discouraging use during periods of high demand. Examples of this include encouraging residential customers to not wash their clothes during peak demand times or an industrial customer not running their equipment during peak demand. When usage can be decreased, there is less need to run higher cost peaking generators.

Megawatt (MW)

One million watts or one thousand kilowatts (KW)

MW_a

Average Megawatts used to reflect energy production rather than capacity. Hydroelectric potential is measured in average MW (MW_a) based on the annual mean flow rates or estimated annual production.

Onshore Wind

Generating electricity by capturing the wind's power. Turbines are placed on land and as the wind blows, the turbine blades spin and in turn, generate electricity.

Offshore Wind

Generating electricity by capturing the wind's power. Turbines are placed in a body of water, such as the ocean or a lake, and as the wind blows, the turbine blades spin and in turn, generate electricity.

Peaking Generation

Generation which has a very quick start time and is used to meet the highest demands for electricity. This generation typically has a capacity factor of less than 20% and often uses a fuel source such as natural gas.

Power Tower

A type of concentrating solar power that uses a field of mirrors to track the sun and focus its light onto a single point on a tower. At this focal point, a fluid (typically air, water or molten salts) is heated and passed through a steam turbine to generate electricity.

Renewable Resources

Any resource, such as wood or solar energy, that can or will be replenished naturally in the course of time.

Reserve Margin

The amount of available capacity of the power system above its anticipated peak load. Ideally, electric generating companies attempt to maintain a constant reserve margin of 12-18% of normal capacity as insurance against unforeseen maintenance, a breakdown in the system or for a sudden increase in energy demand.

Small Hydro

Using the Earth's water, typically in lakes or rivers, to generate electricity. Small hydro is typically defined as those with a generating capacity of up to 10 MW.

Standby Generation

Programs that provide incentives for customers owning generators to utilize them during periods of high demand. This reduces the system peak demand without interrupting service.

Tidal/Wave Energy

Harnessing the ocean's movement, through tides or waves, to generate electricity.

Transmission

The act or process of transporting electric energy in bulk from a source or sources of supply to other principal parts of the system or to other utility systems.

Variable Operating and Maintenance Costs (O&M)

The costs associated with running an electric generating facility that are not stable and subject to change. This includes, but is not limited to the cost of fuel, emission allowances and environmental costs, such as reagents used to reduce emissions.

Voltage Reduction

Lowering the supplied voltage of electricity to all customers which reduces the demand for electricity. This reduction is usually between 2% and 5%.

Watt

The electrical unit of power or rate of doing work. The rate of energy transfer equivalent to 1 ampere flowing under a pressure of one volt.

Watt-Hour

An electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electric circuit steadily for 1 hour.